Emergency Water Supply Q&A

It is recommended that you print this so it's accessible during a power outage.

	Question	Answer
1	**How did drinking contaminated water cause sickness and death prior to the discovery of germs?**	The impact of contaminated water on cities and armies before the discovery of germs was devastating, leading to massive mortality. **How Contaminated Water Caused Sickness and Death** Prior to the formal acceptance of **Germ Theory** (championed by scientists like Louis Pasteur and Robert Koch in the late 19th century), the prevailing explanation for widespread disease was the **Miasma Theory**. • **The Miasma Theory:** People believed that diseases like cholera and the Black Death were caused by "miasma"—a noxious, poisonous vapor or "bad air" emanating from rotting organic matter and foul smells. • **The Resulting Flaw:** This focus on **smell and air** led people to ignore or misunderstand the true danger of **water** contaminated with invisible human waste. • **The Vicious Cycle of Fecal-Oral Disease:** 1. **Cities:** With rapid urbanization and little to no sanitation infrastructure, human and animal waste (feces) was often dumped into streets, cesspools, or directly into rivers. These same rivers were the primary sources of drinking water. Even public wells could be contaminated by leaking nearby cesspits. 2. **Armies (in the field):** Soldiers lived in crowded, unsanitary conditions. Latrines were often dug too close to streams, contaminating the water supply for soldiers downstream. 3. **Transmission:** An infected person would pass the invisible pathogens (bacteria, parasites, viruses) in their stool. This waste would contaminate the water source, which others would drink, ingest the pathogens, and become sick, continuing the cycle.

		Major Diseases Transmitted by Contaminated Water: • **Cholera:** Caused by the *Vibrio cholerae* bacterium. It leads to severe, life-threatening diarrhea and dehydration. The speed and virulence of cholera epidemics in crowded cities made it a terrifying scourge. • **Typhoid Fever:** Caused by the *Salmonella typhi* bacterium. It results in sustained high fever, fatigue, and intestinal problems. • **Dysentery/Diarrhea:** A blanket term for acute intestinal inflammation (often bloody diarrhea), caused by various bacteria (like *E. coli*) or parasites (*Giardia*). These were the most common diseases in armies. The groundbreaking work of **Dr. John Snow** in London in **1854** demonstrated this link decades before germ theory was accepted. By meticulously mapping cholera deaths and tracing them to a single contaminated public water pump, he provided the first clear scientific proof that **contaminated water, not "bad air,"** was the vehicle of transmission. **Warfare Casualties Caused by Disease** Historically, before the early 20th century, **disease—much of it waterborne—was the leading cause of death in armies, vastly exceeding combat wounds.** The most often cited figure, based on historical military records, is that **disease caused approximately two-thirds (66%) of all military deaths** in many conflicts during the "Disease Era" of warfare (roughly 1775-1918). **Key Historical Examples:**

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		<table><tr><th>Conflict</th><th>Disease Deaths vs. Combat Deaths</th><th>Approximate % of Casualties from Disease</th></tr><tr><td>American Civil War (1861-1865)</td><td>About 2 deaths from disease for every 1 combat death.</td><td>~66% of the 620,000 recorded deaths were due to disease (typhoid, diarrhea, dysentery).</td></tr><tr><td>Spanish-American War (1898)</td><td>Nine times as many American soldiers died of disease (yellow fever, typhoid) than from enemy bullets.</td><td>~90% (an extremely high ratio)</td></tr><tr><td>Napoleonic Wars (e.g., invasion of Russia)</td><td>Disease, exhaustion, and starvation accounted for the vast majority of casualties.</td><td>Over 80% of the French Grand Army was lost in Russia, with disease being a major factor.</td></tr></table> It wasn't until World War I, with advances in sanitation, water chlorination, vaccination, and battlefield medicine, that more soldiers on the Western Front were killed by enemy action than by disease.
2	**Can I drink any water?**	**Not all water should be used, even if filtered:** • Rivers and reservoirs that are down stream of industry, large agricultural areas, or populations centers should not be used as they may be too contaminated for your filters to handle. This can include large reservoirs, be careful. • Whenever possible gather it upstream from contamination sources such as pastures (manure), septic systems, parking lots, etc. • If it has a chemical or fuel odor, do not attempt to filter and use it.

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		• If has an oily or fuel-like sheen, do not use it. (note: a fractured or cracked-looking sheen on water may be only a result of natural bacteria, say on a small puddle in the woods, again, use your judgment, better safe than sorry) https://www2.gov.bc.ca/assets/gov/environment/air-land-water/spills-and-environmental-emergencies/docs/materials/watersheen_facts__identifying_sheen.pdf • Cloudy or muddy water can be used as a source, but must be treated and/or filtered.
3	**What water should we avoid?**	**See above answer.**
4	**How are you supposed to make water safe to drink?**	**You need to treat, filter, or boil all water that is not known to be potable.** **Treatment tablets:** • Water treatment tablets like those sold by Aquatabs, Potable Aqua, Primal Survival Gear. • Does not filter out chemicals or fuel, but does kill germs and parasites. **Home made Filters:** • Build a homemade filter by turning a 2-liter (or similar) bottle upside down, and cutting off the bottom, to form a funnel. Layer cotton or cloth (like from a t-shirt, in the neck of the bottle (the bottom of the upside down bottle), followed by crushed clean charcoal, followed by sand, topped off by clean grass, straw or a cloth. These layers will filter out what would clog your more valuable store-bought filter, thus extending its life. Additionally, this filter can be used in place of a store bought filter. **Store bought or manufactured filters/purifier:** • If the water is not clear, before using your store bought filters, prefilter it using a homemade filter, to lengthen the useful life of your store-bought filters. ○ Follow the instructions provided by the manufacturer. Remember, the cleaner the water that goes in, the longer they last.

		○ Many water filters only filter out bacteria, virus, and parasites, nothing else. Understand what your filter can do and get one that can process water outside your home. ○ Life Straw, Sawyer, REI, Berkely, Alexapure, Grayl Geopress, etc. **Boiling:** ○ Boiling is the surest way to kill disease-causing organisms, including viruses, bacteria, and parasites. ○ Bring clear water to a rolling boil for 1 minute. At elevations above 6,500 feet, boil water for 3 minutes. ○ Boiling does NOT remove chemicals. Listen to local authorities about drinking boiled or bottled water. **Bleach:** **DO NOT USE OUTDOOR CLEANING BLEACH IF IT HAS ANY ADDITIONAL CLEANING AGENTS OR CHEMICALS IN IT!** • Bleach does not filter out chemicals or fuel, but does kill germs and parasites. Add enough chlorine to a gallon, drop buy drop, until you can smell chlorine in the container. Shake vigorously and let it site for a few minutes to do its job. Avoid scented bleach, use straight bleach with no additives. Cloudy or muddy water can be used this way also, once you have killed the germs, it may not look good, but it's safe. • **Most importantly, chlorine does not kill Cryptosporidium Sp. so filters or boiling must be used to remove the protozoan.** ○ For emergency disinfection of water that is otherwise visually clear, the standard ratio uses **regular, unscented household liquid chlorine bleach** (typically containing **5% to 9% sodium hypochlorite**):

		○ **Amount per 1 Gallon of Water: 8 drops** of bleach (which is equivalent to about 1/8 teaspoon). ○ If the water is **cloudy, murky, or very cold**, you should **double the amount** to 16 drops (or 1/4 teaspoon) per gallon. **Important Safety Steps** ○ For the disinfection to be effective and safe, you must follow these steps: ○ **Filter First:** If the water is cloudy or has debris, filter it first through a clean cloth, paper towel, or coffee filter to remove suspended solids. Bleach works best on clear water. ○ **Use Unscented Bleach Only:** You must use plain, **unscented** household bleach. Do **not** use color-safe, splash-less, scented, or gel-formula bleaches, as they contain additives that are unsafe for consumption. ○ **Mix and Wait:** Add the measured bleach, stir the water well, and let it stand for at least **30 minutes**. ○ **Check Odor:** After 30 minutes, the water should have a slight chlorine odor. If it does not, repeat the dosage (8 more drops) and let it stand for another 15 minutes before consumption. ○ Boiling water for one full minute is generally the most effective way to kill pathogens, but chemical disinfection with bleach is a viable alternative when boiling is not possible. In general, **undiluted household liquid bleach** (5-9% sodium hypochlorite) has a shelf life of approximately **six months to one year** from the date of manufacture.

		Here's a quick breakdown of what causes it to degrade and how to tell if household bleach is still effective: **Why Bleach Expires** Bleach does not "go bad" in the traditional sense, but its active ingredient, **sodium hypochlorite**, is highly unstable. Over time, it naturally breaks down into salt and water. This process is accelerated by: • **Heat and Sunlight:** Storing bleach in a hot garage or near a sunny window drastically shortens its lifespan. The ideal temperature range is generally between 50◦F and 70◦F (10◦C and 21◦C). • **Time:** Even when stored perfectly, the process of degradation begins the moment the bleach is made. Manufacturers often recommend replacing it annually, especially if you rely on it for critical **disinfection** (like purifying water or sanitizing surfaces). • **Dilution:** Once you mix bleach with water to create a cleaning or disinfection solution, it becomes highly unstable. A diluted bleach solution loses its disinfecting properties and is only reliably effective for about **24 hours**. You should always mix a fresh batch daily for cleaning purposes. **How to Tell If Your Bleach is Still Good** Since manufacturers typically stamp a production code rather than an expiration date, the easiest way to check if your bleach is still potent is by observing it: 1. **Check the Date:** If you remember buying the bottle more than **12 months ago**, it's best to replace it, as its disinfecting power has likely dropped significantly. 2. **Smell Test:** Bleach should have a noticeable, faint **chlorine odor** when you open the bottle or pour a little out. If you don't smell anything at all, it has mostly degraded into saltwater and should no longer be relied upon for disinfection or water treatment.

		3. **Appearance:** If the liquid has turned noticeably darker yellow or murky, it's a sign of degradation. If you are using bleach for emergency water purification, it's a good practice to ensure you're using a relatively **fresh bottle** (bought within the last 6-12 months) and that it has been stored in a cool, dark place.
5	**Which filter or purifier remove bacteria and parasites?**	For a water filter or purifier to effectively remove bacteria and parasites, you need a system that uses one of the following methods: **1. Absolute Filters (Physical Filtration)** The most common and reliable method is using a filter with a pore size small enough to physically block the microorganisms. • **Bacteria** size: typically about 0.2 to 2 microns. • **Parasites** (like *Giardia* and *Cryptosporidium* cysts): typically 2 to 10 microns. Therefore, look for filters with an **Absolute Pore Size** of **1 micron or smaller** (often microns or microns are used for a higher safety margin against bacteria). • **Microfiltration (MF):** Usually removes parasites and most bacteria (e.g., to micron filters). • **Ultrafiltration (UF):** Has a smaller pore size (e.g., microns) and effectively removes both **bacteria and parasites**. • **NSF Certification:** For consumer products in the US, look for filters certified to **NSF/ANSI Standard 53 or 58 for "cyst removal" or "cyst reduction."** This specifically verifies the filter's ability to remove the chlorine-resistant parasites like *Giardia* and *Cryptosporidium*. **2. Reverse Osmosis (RO)** Reverse osmosis systems are extremely effective. They work by forcing water through a very fine, semi-permeable membrane.

		• **Removes: Bacteria, parasites, and even viruses**, along with a wide range of chemical contaminants and heavy metals. • **Pore Size:** Extremely small (around microns). • **Note:** RO systems often require a sediment and carbon pre-filter and produce wastewater, but they offer one of the highest levels of purification. **3. UV (Ultraviolet) Treatment (Disinfection)** UV purifiers use UV light to kill or inactivate microorganisms by disrupting their DNA, preventing them from reproducing and causing infection. • **Removes:** Highly effective against **bacteria, viruses, and parasites**. • **Note:** UV treatment does not *remove* the particles from the water; it just makes them harmless. For best results, UV systems should always be paired with a sediment filter to ensure the water is clear (low turbidity), as cloudy water can shield the microbes from the UV light. **What is NOT Enough:** • **Basic Granular Activated Carbon (GAC) Filters:** While great for removing chlorine, improving taste/odor, and reducing some chemicals, GAC filters **do not** have a pore size small enough to consistently remove bacteria or parasites. They must be combined with one of the filtration or purification methods listed above. • **"Nominal" Filters:** A filter rated as "nominal 1 micron" will allow a certain percentage of particles of that size to pass through, making it less reliable for pathogen removal than an "absolute" filter. **In summary, for reliable removal of bacteria and parasites, look for a system that features Microfiltration/Ultrafiltration (micron or smaller absolute pore size), Reverse Osmosis, or UV Disinfection, and check for NSF certification for cyst removal.**

6	**Which filter or purifier can remove water-borne virus?**	Some of the most concerning and dangerous waterborne viruses for humans include: • **Hepatitis A Virus (HAV):** Causes Hepatitis A, an acute liver infection. While often self-limiting, it can cause serious illness and is a major concern in areas with inadequate sanitation. • **Hepatitis E Virus (HEV):** Causes Hepatitis E, another form of acute viral hepatitis. It is particularly dangerous for pregnant women, where the mortality rate can be up to 25%. It is common in many parts of the world with poor sanitation. • **Norovirus (NoV):** A highly contagious virus that is the leading cause of outbreaks of viral gastroenteritis (often called "stomach flu") worldwide. It causes severe vomiting and diarrhea, which can lead to life-threatening dehydration, especially in young children, the elderly, and immunocompromised individuals. • **Rotavirus (RV):** A major cause of severe acute diarrhea in infants and young children globally. Before the introduction of widespread vaccination, it resulted in hundreds of thousands of deaths in children each year worldwide. • **Enteroviruses (EVs) (including Poliovirus and Coxsackievirus):** This group includes viruses that can cause a range of illnesses from mild gastroenteritis to more severe conditions like meningitis, encephalitis, and myocarditis. Poliovirus, though largely controlled by vaccination, causes poliomyelitis, which can lead to paralysis or death. • **Adenoviruses (AdVs):** Can cause gastroenteritis, respiratory, ocular (eye), and urinary tract infections. Some strains are very resistant to common water treatment methods like UV light. These viruses are typically transmitted through the **fecal-oral route**, meaning water becomes contaminated by the feces of infected individuals or animals, and then a person ingests the contaminated water. It's important to note that many deadly waterborne illnesses are caused by **bacteria** (like *Vibrio cholerae* causing cholera, or *Salmonella typhi* causing typhoid fever) or **parasites** (like *Cryptosporidium* and *Giardia*), in addition to the dangerous viruses listed above.

		It's important to distinguish between water filters and water purifiers when considering virus removal, as viruses are much smaller than bacteria and protozoa. • Water Filters typically use a pore size of around 0.1 to 0.2 microns and are very effective at removing bacteria and protozoa (like Giardia and Cryptosporidium). Most standard backpacking filters (like many popular Sawyer and Katadyn models) do not remove viruses. • Water Purifiers are necessary to remove or inactivate viruses, which are smaller (typically to microns). Purification can be achieved through: Backpacking Water Purifiers that Target Viruses: 1. Mechanical Purifiers (Ultrafiltration): These use an extremely small pore size (often 0.005 to 0.1 microns or smaller) to physically filter out viruses. o MSR Guardian Purifier: A high-end pump-style purifier originally designed for the military. It is certified to remove bacteria, protozoa, and viruses. o LifeStraw Purifiers: Some models, such as the LifeStraw Peak Series Gravity Purifier with Virus Removal or the LifeStraw Family/Mission systems, use an ultrafilter membrane (e.02 micron pore size) to remove viruses, bacteria, and protozoa. o Grayl GeoPress/UltraPress: These "press" style bottles use an electroabsorption and activated carbon filter cartridge to remove viruses, bacteria, and protozoa. 2. Chemical Purification: This method uses a chemical to kill or inactivate the pathogens, including viruses. o Katadyn Micropur Tablets or Aquamira Water Treatment Drops: These products typically use chlorine dioxide, which is effective against viruses, bacteria, and protozoa. They require a specific contact time before the water is safe to drink. 3. Ultraviolet (UV) Light Purifiers: These devices use UV light to inactivate microorganisms, disrupting the DNA of bacteria, protozoa, and viruses so they cannot reproduce. o Katadyn SteriPEN: A popular portable UV light wand. The water needs to be relatively clear for the UV light to be fully effective. Key Considerations:

		• Location: Viruses are less of a concern in the backcountry of the US and Canada but are a serious risk when traveling internationally, especially in less-developed areas. • Cost/Weight: Purifiers (especially pump models like the MSR Guardian) tend to be heavier and more expensive than simple microfilters. • Speed and Ease of Use: Systems like the Grayl bottles or UV pens can be very fast, while chemical treatments require a wait time. Gravity purifiers (like the LifeStraw Peak Gravity Purifier) can process larger volumes at a good flow rate.
7	**Which hiking filters are good at removing chemical contamination?**	This is a great and important question, as most standard backpacking water filters **do not** remove chemical contaminants. Here's a breakdown of the best approaches and products for chemical removal while hiking: **The Best Defense: Activated Carbon (Adsorption)** The most common and effective method for removing many chemical contaminants in a portable hiking filter is using **activated carbon (or activated charcoal)**. • **How it Works:** Activated carbon works through a process called **adsorption**, where organic chemical compounds like pesticides, herbicides, industrial solvents, and volatile organic compounds (VOCs) stick to the surface of the carbon. It also significantly improves the water's taste and odor by removing chlorine. • **Limitation:** While excellent for organic chemicals, activated carbon is **less effective at removing dissolved heavy metals** (like lead or arsenic) or inorganic contaminants like fluoride and nitrates. **Filter/Purifiers That Target Chemicals and Heavy Metals**

		For the most comprehensive protection against chemicals and heavy metals, look for a purifier system that incorporates multiple stages, typically including a filter for pathogens and a specialized adsorption or ion-exchange medium (often activated carbon). The top models frequently recommended for chemical, heavy metal, and virus removal include: 1. **Grayl Purifier Bottles (e.g., GeoPress or UltraPress):** ○ **Technology:** They use a press system with a cartridge that combines electro-adsorption and activated carbon. ○ **Removal:** Claim to remove protozoa, bacteria, viruses, **chemicals, and heavy metals.** ○ **Pros:** Extremely fast and easy to use (fill, press, drink). ○ **Cons:** Filter lifespan is relatively short (around 300-400 cycles/gallons) and they are bulkier and heavier than simple hollow fiber filters. 2. **MSR Guardian Purifier:** ○ **Technology:** A pump-style filter using hollow fiber technology with very small pores (0.02 microns) to remove *viruses*, bacteria, and protozoa. It is often combined with an **activated carbon element (like MSR's carbon element or an additional step)** to address chemicals and improve taste, as the base hollow fiber filter does not remove chemicals. ○ **Removal:** The *purifier* version removes viruses, bacteria, and protozoa. The addition of carbon addresses chemicals. ○ **Pros:** Highly durable, reliable, self-cleaning, and military-grade. ○ **Cons:** Expensive and relatively heavy. 3. **Katadyn Hiker Pro/Vario (and similar pump filters):** ○ **Technology:** These often combine a depth or ceramic pre-filter with a core of **activated carbon granules** to address taste, odor, and chemicals.

		○ **Removal:** Typically remove bacteria and protozoa, with the activated carbon stage reducing chemicals and improving taste. ○ **Pros:** Good for turbid water and shallow sources. ○ **Cons:** Pumping is required, and they are heavier than squeeze filters. **Important Note on Standard Filters** Most popular, lightweight hiking filters (like the **Sawyer Squeeze/Mini**, **Katadyn BeFree**, and most simple **Hollow Fiber filters**) are excellent at removing **bacteria and protozoa** (like Giardia and Cryptosporidium), but **do not** remove viruses, chemicals, or heavy metals. **In summary, if chemical contamination is your primary concern, look for a purifier that specifically includes an activated carbon stage, or uses a technology like electro-adsorption, and ideally has independent lab testing to back up its chemical removal claims.**
8	**Which counter top filters remove chemical contamination?**	The countertop filters most effective at removing a wide range of chemical contaminants are typically those that use **Reverse Osmosis (RO)** or a combination of **Multiple Advanced Technologies** including high-quality **Carbon Block** filtration. Here is a breakdown of the effective technologies and what to look for: **1. Reverse Osmosis (RO) Systems** Countertop RO systems are generally considered the "gold standard" for removing the most comprehensive list of contaminants, including many difficult-to-remove chemicals.

		• **How they work:** Water is forced under pressure through a semi-permeable membrane that has extremely tiny pores, which blocks particles and molecules larger than water, including most inorganic and organic chemical contaminants.
		• **Chemicals they remove effectively:**
		  ○ **"Forever Chemicals" (PFAS/PFOA/PFOS)**
		  ○ **Heavy Metals** (e.g., Lead, Arsenic, Chromium-6)
		  ○ **Nitrates** and **Fluoride**
		  ○ **Pesticides & Herbicides**
		  ○ **Volatile Organic Compounds (VOCs)**, including some industrial solvents and disinfection byproducts.
		
		Note: Countertop RO systems often include multiple stages: a sediment filter, a carbon block filter (to protect the RO membrane by removing chlorine/chemicals), the RO membrane, and a final polishing filter.
		
		2. Advanced Carbon Block & Specialty Filters
		
		High-quality, certified carbon block filters, often used in gravity-fed or direct-connect countertop systems, are very effective for many common chemicals.
		
		• **How they work:** Activated carbon uses **adsorption**, where chemicals stick to the porous surface of the carbon as water passes through. Carbon **block** filters, which are denser than granular activated carbon (GAC), generally provide better chemical removal.
		• **Chemicals they remove effectively:**
		  ○ **Chlorine** and **Chloramines** (greatly improving taste and odor)
		  ○ **Volatile Organic Compounds (VOCs)**
		  ○ **Pesticides & Herbicides**

		○ **Certain Heavy Metals** (like lead, often using ion exchange alongside the carbon). **Key Certifications to Look For** The best way to verify a filter's ability to remove specific chemicals is to look for **Third-Party Testing and Certification** by organizations like **NSF International, WQA (Water Quality Association),** or **IAPMO**. Look for the following standards on the product's packaging or documentation: • **NSF/ANSI Standard 53 (Health Effects):** Certifies the reduction of specific health-related contaminants, including **Lead, VOCs,** and **Cysts**. • **NSF/ANSI Standard 58 (Reverse Osmosis):** Specifically for RO systems, certifying the reduction of contaminants like **Nitrates, Arsenic, Cysts,** and **Total Dissolved Solids (TDS)**. • **NSF/ANSI Standard 401 (Emerging Compounds/Incidental Contaminants):** Certifies the reduction of up to 15 contaminants, including some **Pharmaceuticals, Herbicides, and Pesticides** (like ibuprofen, naproxen, and BPA). • **P473 (PFOA/PFOS):** Certifies the reduction of **"Forever Chemicals"** (PFAS). This is now often incorporated into NSF 53 or 58. **Before buying any filter, it is highly recommended to:** 1. **Check your local water quality report** (provided by your utility company). 2. **Test your water** if you are on a well or concerned about lead or specific local contaminants. 3. **Choose a filter certified to remove the specific chemicals you are concerned about.**

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9	**What filters can remove bacteria, parasites, virus, and chemicals?**	Filters that can remove all four contaminants—**bacteria, parasites, viruses, and chemicals**—often use a combination of technologies in a multi-stage system. The most common and highly effective technologies used to target all four include: 1. **Reverse Osmosis (RO) Systems:** ○ **How it works:** Water is forced under pressure through a semipermeable membrane with extremely fine pores. ○ **Removal capability:** RO is highly effective at removing a very broad spectrum of contaminants, including most **chemicals** (dissolved salts, heavy metals, nitrates, fluoride, PFAS, and other dissolved solids), **bacteria**, **parasites**, and **viruses**. Home RO systems typically include activated carbon and sediment filters as pretreatment. 2. **Combined Filtration and Purification Systems:** ○ Many comprehensive systems, including some advanced portable filters or whole-house units, use a combination of methods: ▪ **Ultrafiltration (UF) or Nanofiltration Membranes:** These are very fine physical filters (often to microns) that can physically block **bacteria** and **parasites**. Ultrafiltration at its finest level (often combined with a carbon filter) can also remove some **viruses** and **chemicals**. ▪ **Activated Carbon Filters:** These work by **adsorption**, effectively reducing many **chemicals** like chlorine, pesticides, herbicides, volatile organic compounds (VOCs), and improving taste and odor. Activated carbon is essential for chemical removal but generally *does not* remove viruses or all bacteria. ▪ **UV (Ultraviolet) Disinfection:** UV light is a purification method often used in conjunction with filters. It kills or inactivates 99.99% of **bacteria, parasites, and viruses** by scrambling their DNA, making them unable to

		reproduce and cause illness. **It does not remove chemicals or sediment**, so it is almost always the final step in a multi-stage system. **For a single system to cover all four, you generally need:** • **A Reverse Osmosis (RO) System** (typically combined with carbon and sediment pre-filters). • **A multi-stage system that includes both a fine membrane filter (for microbes) AND an activated carbon filter (for chemicals), potentially with a UV treatment stage (to ensure virus removal).** When selecting a filter, look for systems that are certified by a third-party organization like **NSF International** for the specific contaminants you are concerned about. For microbiological contaminants, the **NSF P231** protocol is often cited for its testing against bacteria, viruses, and cysts (parasites).
10	**Where can I get water?**	**Plumbing water remnants:** • The toilet tank above the toilet bowl holds drinkable water • Your hot water tank does also • Garden hoses may have water in them • The "S" curves beneath your sinks hold grey water that might be filtrable, depending on soap or cleaning chemicals in it. Do not try to filter soapy water or water containing cleaning chemicals. **Surface Water:** • Whenever possible gather it upstream from contamination sources such as pastures (manure), septic systems, parking lots, etc.

		Rain water: • Collect from downspouts into a container such as rain barrel. • Ensure you use a container that is made of materials safe for human consumption, and that no plastic or chemical leaching will get into your water. The longer it sits in the container, the more that will leach into the water. • You can order kits online for this. Larger systems can include agriculture or landscaping tanks, but again, make sure the container is safe for human consumption. Tractor Supply and Amazon have them. **Well:** • You may be able to run your well using your backup power supply. Ensure you have it properly and safely connected. • You can build a manual well pump to extract water from a modern well using PVC tubing. See this video: https://youtu.be/B6T_kVm651w **Seepage Well:** • A seepage well is a shallow pit dug in a low-lying area, like next to a creek or pond, to collect water that naturally seeps from the ground. This method takes advantage of the water table's proximity to the surface. It can be a useful way to access a clean, continuous water supply, as the ground often acts as a natural filter. **Solar Stills:** • A **solar still** is a simple, homemade device that uses the sun's energy to distill water through evaporation and condensation, making contaminated water safe to drink. This method is effective for purifying salty, murky, or otherwise unsafe water. Water with a chemical or fuel odor or sheen may not be suitable for this method as the contaminates

		may evaporate along with the water and condense into your collection cup with the water.
		• **Materials Needed:**
		  ○ **A large, waterproof basin:** A bucket, bowl, or even a dug-out hole in the ground can serve as the basin.
		  ○ **Contaminated water:** The water you want to purify.
		  ○ **A collection cup:** A clean cup, bowl, or small bottle to catch the distilled water.
		  ○ **Clear plastic sheeting:** A large, clear plastic bag, tarp, or sheet of plastic wrap works well.
		  ○ **A small rock or weight:** To create a low point in the plastic sheet for the water to drip into the collection cup.
		• **Instructions:**
		  ○ **Dig a pit (optional):** If you're using the ground as your basin, dig a pit about 3 feet across and 2 feet deep in a sunny spot.
		  ○ **Place the basin and cup:** Put the basin in the pit or on a flat surface. Place your clean collection cup in the center of the basin, making sure it's stable and won't tip over.
		  ○ **Pour in contaminated water:** Fill the outer basin with the contaminated water. Be careful not to splash any into your collection cup. You can also place leafy, non-poisonous plants in the basin to aid in the evaporation process.
		  ○ **Cover with plastic:** Securely stretch the clear plastic sheeting over the top of the basin, creating a tight seal. You can use rocks or dirt to hold the edges down.
		  ○ **Place the weight:** Place a small rock or weight directly over the center of the collection cup, on top of the plastic sheet. This will create a downward-sloping cone that directs the condensed water droplets into the cup.

		○ **Wait and collect:** Leave the still in a sunny location. After several hours, you will start to see water droplets forming on the underside of the plastic, which will then drip into your collection cup. ○ Solar stills are excellent for emergency situations or for use in remote areas where clean water is scarce. They are a passive, low-maintenance way to produce a reliable supply of drinking water.
11	**How much water should we have available?**	**Drinking per person/pet:** The general recommendation for how much water to drink per day is often cited as the "8x8 rule," which is eight 8-ounce glasses (64 ounces or about 1.9 liters). However, this is an oversimplification, and a more accurate approach considers various factors. The U.S. National Academy of Medicine provides more specific adequate intake recommendations for total water (from all beverages and foods): • For men: Approximately 15.5 cups (3.7 liters) per day. • For women: Approximately 11.5 cups (2.7 liters) per day. About 20% of your total fluid intake typically comes from the foods you eat, with the rest coming from drinks, including water. Factors That Influence Your Water Needs: Your individual water requirement is highly variable and depends on several factors: • Physical Activity: When you exercise, you sweat and lose water. You need to drink more to replace these fluids. The American College of Sports Medicine recommends adding about 12 ounces of water for every 30 minutes of exercise. • Climate and Environment: Living in a hot, humid, or high-altitude environment increases fluid loss through sweat and breathing, requiring a higher water intake.

		• Health and Illness: Illnesses like fever, vomiting, or diarrhea can cause significant fluid loss. Certain health conditions, such as kidney stones, may also require increased fluid intake as a preventative measure. • Diet: A diet high in salty foods, spicy foods, or protein can increase your body's need for water. Conversely, a diet rich in water-dense fruits and vegetables (like watermelon, cucumber, and lettuce) can contribute significantly to your daily fluid intake. • Pregnancy and Breastfeeding: Pregnant and breastfeeding women have increased fluid needs to support their own bodies and the baby's development. A Practical Guideline: Listen to Your Body A simple and effective way to gauge your hydration level is to pay attention to your body's signals and the color of your urine. • Thirst: Thirst is a key indicator that your body needs water. • Urine Color: Your urine should be a pale, clear yellow. If it is dark yellow or amber, it is a sign that you are likely dehydrated and need to drink more fluids. **Cooking per person:** you will need 2-3 cups of water per cup of rice or corn meal or beans. Other requirements will vary. You can re-use water that is normally poured off noodles or similar items, if need be. **Cooking utensil cleanup**: scrape well, then use a damp cloth or sponge to soap down the item, dip In rinse water, then sparingly re-rinse if needed with fresh water. You can use non potable water with a bit of bleach for rinse water. **Hygiene per person:** Minimum will be enough to brush your teeth and do a standing bath for your face, feet, crotch, armpits. This can be accomplished with a damp washcloth that is rinsed after you soap up. 2 cups (16 ounces) is adequate, and less when you get practiced. The body wash water does not need to be potable.

Emergency Water Supply Q&A

<table>
<tr><td></td><td></td><td>Agriculture/irrigation: customize your plan to meet your requirements</td></tr>
<tr><td>12</td><td>How long can you store water?</td><td>Indefinitely if well sealed in a safe food grade container. If not in such a container, it could leak or evaporate, or require treatment and filtering before use. It is recommended that you only purify what you need each day, and not attempt to store large volumes of potable water unless you have a system specifically designed for that.

Shelf Life of Stored Water
<table>
<tr><th>Water Source/Type</th><th>General Shelf Life</th><th>Rotation Frequency (Recommendation)</th><th>Key Consideration</th></tr>
<tr><td>Commercially Bottled Water (Unopened)</td><td>Indefinite (from a safety perspective)</td><td>Consume by the "best-by" date (usually 1 to 2 years from bottling) for best taste and quality.</td><td>The date is for the plastic bottle degradation, not the water itself. Avoid heat and sunlight.</td></tr>
<tr><td>Home-Stored Tap Water (Disinfected)</td><td>Indefinitely (from a safety perspective)</td><td>Every 6 months</td><td>Must be stored in clean, food-grade containers and kept cool, dark, and away from chemicals.</td></tr>
</table></td></tr>
<tr><td>13</td><td>How would we make a fire to boil the water?</td><td>Fire starter classes needed.

Charcoal and lighter fluid
Magnifying glass or Fresnel lens
Striker spark kit
Solo Stove or similar: https://www.solostove.com/us/en-us
Have plenty of tinder and the right size wood to build the fire until you have a good set of coals to keep it going.</td></tr>
</table>

Emergency Water Supply Q&A

		Keep in mind safety, ensure you have a ring of stones or other non-flammable material around the fire so it won't spread, watch out for flying sparks, keep water on hand for safety and to put it out when finished.
14	**How would we cut wood for a fire to boil water?**	Chainsaws, hand saws, axes and hatchets. Know how to use and maintain the chainsaw. Be prepared with a backup plan if you run out of fuel o it breaks. Split the wood by hand using splitting edges and mallets, a splitting maul, or axe. Mechanical splitters can be sued, have a backup plan for when they don't work.
15	**Where can we get a rain barrel?**	Repurposed 55-gallon drums (be certain they were not used for chemical or fuel use) Purchase from Tractor Supply, Amazon, or similar.
16	**What plastics are safe to store water in? (PBA free)?**	Large containers: use food grade materials or those safe for livestock. Small containers, again use food grade or avoid certain plastics that can leach chemicals into the water, seek BPA-free plastics etc.
17	**Why are you seriously talking about this?**	See Black Sky Event references at www.fir.foundation. Watch these videos: 60 Minutes episode about the Grid (approx. 15 min) Grid Down Power Up trailer (approx. 2 min) EIS Council Black Sky Event (approx. 15 min, a bit dated, but makes good points) FBI Director- China cyber and our infrastructure (approx. 6 min) General John Wickert: China threat and the grid (see the 27:45 - min mark, approx. 40 min total) Failure to defeat Russia opens the door for China to seize Asia, expert warns (approx. 7 min) Grid Down Power Up Documentary (narrated by Dennis Quaid)
18	**Well aren't we going to be raptured out before this?**	Likely not, just like the WW2 generation was not.
19	**Why will we not have city water?**	Without electricity, there will be no power to pump the water.

		See Black Sky Event references at www.fir.foundation. Watch these videos: 60 Minutes episode about the Grid (approx. 15 min) Grid Down Power Up trailer (approx. 2 min) EIS Council Black Sky Event (approx. 15 min, a bit dated, but makes good points) FBI Director- China cyber and our infrastructure (approx. 6 min) General John Wickert: China threat and the grid (see the 27:45 - min mark, approx. 40 min total) Failure to defeat Russia opens the door for China to seize Asia, expert warns (approx. 7 min) Grid Down Power Up Documentary (narrated by Dennis Quaid)